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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/807,890	03/24/2004	Zhidan Li Tolt	372668-00101	5356

37509 7590 02/27/2006

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EXAMINER	
DONG, DALEI	
ART UNIT	PAPER NUMBER
2879	

DATE MAILED: 02/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/807,890	TOLT, ZHIDAN LI	
	Examiner	Art Unit	
	Dalei Dong	2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-68* is/are pending in the application.

4a) Of the above claim(s) *45-54* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-44 and 55-68* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *08/04, 06/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-44 and 55-68 are, drawn to a electron source, classified in class 313, subclass 311.

II. Claims 45-54 are, drawn to a method of fabricating an electron source, classified in class 445, subclass 51.

The inventions are distinct, each from the other because of the following reasons:

Inventions of Group I and Group II are related as product made and process of making. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, instead of truncating and exposing the ends of the nano-structures by polishing the surface of the emitter layer; this step could be accomplished by chemical etching. Invention of Group II is classified in a different class and subclass, therefore provides extra burden upon the Examiner and thus restriction is deemed proper. The criteria for establishment of restriction is if it can be shown that the product made can be manufactured by an entirely different process as claimed by applicant. Because the method of making and the apparatus made of an electron source are distinct invention as acquired a separate status in the art as shown by their different classification, restriction for examiner purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventor is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

During a telephone conversation with Mr. Anthony B. Diepenbrock III on February 15, 2006 a provisional election was made without traverse to prosecute the invention of an electron source, claims 1-44 and 55-68. Affirmation of this election must be made by applicant in replying to this Office action. Claims 45-54 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-4, 6, 7, 9, 11-21, 23, 25, 26, 28-36 and 39-44 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,777,427 to Tanaka.

Regarding to claim 1, Tanaka discloses in Figures 1-4 and 13, an electron source comprising: a substrate (42); a cathode (52) disposed over the substrate (42), the cathode (52) for providing a source of electrons; an emitter layer (54 and 56) disposed over the cathode (52) and formed from a composition of an embedding material (54) and a plurality of nano-structures (56) embedded therein, the emitter layer (54 and 56) having a surface at which ends of the nano-structures are truncated and exposed for emitting electrons; an insulator (46) disposed over the emitter layer, the insulator having one or a plurality of apertures (50) for exposing the ends of the nano-structures; and a gate electrode (48) disposed over the insulator (46) and having one or a plurality of apertures that are aligned with the apertures in the insulator (46), the gate electrode (48) for controlling the emission of electrons through the apertures from the exposed nano-structures.

Regarding to claim 2, Tanaka discloses in Figures 1-4 and 13, a vacuum is present in the apertures of the gate electrode (48) and the insulator (48); (see column 8, lines 4-16) and wherein an electric field is present in the vacuum between the exposed ends of the nano-structures in the surface of the emitter layer (54 and 56) and the gate electrode

(48), the electric field having an intensity that is increased over its vacuum intensity by the presence of the embedding material in the emitter layer (see column 8, lines 43-54).

Regarding to claim 3, Tanaka discloses in Figures 1-4 and 13, the exposed ends of the nano-structures are at substantially the same distance from the gate electrode (48).

Regarding to claim 4, Tanaka discloses in Figures 1-4 and 13, the embedding material (54) is composed of a single material (carbon).

Regarding to claim 6, Tanaka discloses in Figures 1-4 and 13, the nano-structure has at least one of its three dimensions in the nanometer range.

Regarding to claim 7, Tanaka discloses in Figures 1-4 and 13, the nano-structure includes nano-tube, nanowires, nano-cone, nano-fiber, nano-particle, and nano-plane (see column 9, lines 1-5).

Regarding to claim 9, Tanaka discloses in Figures 1-4 and 13, the nano-structures are grown randomly.

Regarding to claim 11, Tanaka discloses in Figures 1-4 and 13, the exposed end of the nano-structure is slightly recessed from the surface of the emitter layer.

Regarding to claim 12, Tanaka discloses in Figures 1-4 and 13, the exposed end of the nano-structure protrudes slightly from the surface of the emitter layer.

Regarding to claim 13, the limitation of the nano-structures are exposed by a chemical mechanical planarization process is merely the process of fabricating of the electron source. Please note that the claimed method steps are product by process limitations. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of product. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Furthermore, it is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation. Consequently, absent a showing of an obvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (see MPEP 2113).

Regarding to claim 14, the limitation of the nano-structures are exposed by a combination of lithography and chemical etch is merely the process of fabricating of the electron source. Please note that the claimed method steps are product by process limitations. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of

a product does not depend on its method of product. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Furthermore, it is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation. Consequently, absent a showing of an obvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (see MPEP 2113).

Regarding to claim 15, the limitation of the surface of the emitter layer is treated to induce atomic bonding to the ends of the truncated nano-structures is merely the process of fabricating of the electron source. Please note that the claimed method steps are product by process limitations. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of product. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Furthermore, it is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation. Consequently, absent a showing of an obvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (see MPEP 2113).

Regarding to claim 16, Tanaka discloses in Figures 1-4 and 13, the nano-structures are conductive and the embedding material is an insulating material.

Regarding to claim 17, Tanaka discloses in Figures 1-4 and 13, the insulating material that is selected from a group of materials consisting of: ferroelectric materials, oxides, nitrides, carbides, diamond-like carbon, un-doped semiconductors, glasses, organically modified glasses, insulating ceramics and composites, and cured organic resins (see column 8, lines 33-42).

Regarding to claim 18, Tanaka discloses in Figures 1-4 and 13, the conductive nano-structures are selected from a group of materials consisting of: carbon, doped-semiconductor, refractory 3 metals and alloys, and conductive ceramics (see column 8, lines 33-42).

Regarding to claim 19, Tanaka discloses in Figures 1-4 and 13, the carbon includes carbon nano-tube, carbon nano-fiber, carbon nano-cone, carbon nano-particle and carbon nano-plane (see column 8, lines 33-42).

Regarding to claim 20, Tanaka discloses in Figures 1-4 and 13, the conductive nano-structures are formed from an insulating core and a conductive shell.

Regarding to claim 21, Tanaka discloses in Figures 1-4 and 13, the insulating core is a wide band gap semiconductor that includes AlN, AlGaN, BN, SiC, diamond, GaN.

Regarding to claim 23, Tanaka discloses in Figures 1-4 and 13, the conductive nano-structures are grown randomly.

Regarding to claim 25, Tanaka discloses in Figures 1-4 and 13, the conductive nano-structures are a composite structure having alternating insulating and conductive layers.

Regarding to claim 26, Tanaka discloses in Figures 1-4 and 13, the embedding material is conductive and nano-structures are insulators.

Regarding to claim 28, Tanaka discloses in Figures 1-4 and 13, the insulator nano-structures are grown randomly on the substrate.

Regarding to claim 29, the limitation of the insulator nano-structures are pre-fabricated and deposited on the substrate by printing, spin coating, extrusion coating, dipping, and doctor blade is the method of fabricating an electron source. Please note that the claimed method steps are product by process limitations. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not

depend on its method of product. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Furthermore, it is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation. Consequently, absent a showing of an obvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (see MPEP 2113).

Regarding to claim 30, Tanaka discloses in Figures 1-4 and 13, the insulator nano-structures are selected from a group consisting of: wide band gap semiconductors, oxides, carbides, nitrides and semiconductors.

Regarding to claim 31, Tanaka discloses in Figures 1-4 and 13, the wide-band semiconductors include diamond, BN, GaN, AlN, AlGaN, GaAs, SiC, ZnO.

Regarding to claim 32, Tanaka discloses in Figures 1-4 and 13, the conductive embedding material is selected from the group consisting of: conductive ceramics, conductive composites, metals, metal alloys, doped semiconductors, and conductive polymers.

Regarding to claim 33, Tanaka discloses in Figures 1-4 and 13, the conductive composites include carbon dispersed in glasses.

Regarding to claim 34, Tanaka discloses in Figures 1-4 and 13, the nano-structures are conductive and the embedding material is conductive.

Regarding to claim 35, Tanaka discloses in Figures 1-4 and 13, the conductive nano-structures are selected from a group of materials consisting of: carbon, regactory metals, refractory alloys, conductive ceramics, and doped semiconductors.

Regarding to claim 36, Tanaka discloses in Figures 1-4 and 13, carbon includes carbon nano-tube, carbon nano-fiber, carbon nano-cone, carbon nano-particles, and carbon nano-planes.

Regarding to claim 39, the limitation of the insulator nano-structures are pre-fabricated and deposited on the substrate by printing, spin coating, extrusion coating, dipping, and doctor blade is the method of fabricating an electron source. Please note that the claimed method steps are product by process limitations. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of product. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though

the prior product was made by a different process. In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Furthermore, it is well established that a claimed apparatus cannot be distinguished over the prior art by a process limitation. Consequently, absent a showing of an obvious difference between the claimed product and the prior art, the subject product-by-process claim limitation is not afforded patentable weight (see MPEP 2113).

Regarding to claim 40, Tanaka discloses in Figures 1-4 and 13, the conductive embedding material is selected from the group consisting of: refractory metals, refractory alloys, conductive ceramics, conductive composites, doped semiconductor thin films, and conductive polymers.

Regaridng to claim 41, Tanaka discloses in Figures 1-4 and 13, the conductive composites include carbon dispersed in glasses.

Regarding to claim 42, Tanaka discloses in Figures 1-4 and 13, the cathode electron is configured as rows of substantially parallel strips, each cathode strip for providing an independent source of electrons; wherein the gate electrode is configured as columns of substantially parallel strips, each column strip intersecting with the rows of cathode strips at intersection patches and having one or a plurality of apertures at each intersection patch, wherein each gate electrode is configured to control the emission of electrons through the apertures along the gate electrode; and wherein activation of a

selected cathode strip and a selected gate electrode strip determine the intersection patches that emit electrons.

Regarding to claim 43, Tanaka discloses in Figures 1-4 and 13, an electron source comprising: a substrate (42); a cathode (52) disposed over the substrate (42) and having side walls, the cathode for providing a source of electrons; an emitter layer (54 and 56) disposed over a side wall of the cathode and formed from a composition of an embedding material (54) and one or a plurality of nano-structures (56) embedded therein, the emitter layer (54 and 56) having a surface at which ends of the nanostructures are truncated and exposed for emitting electrons; and a gate electrode (48) disposed over the substrate and having a side wall spaced apart from and facing the emitter layer, the gate electrode for controlling the emission of electrons from the exposed nano-structures of the facing emitter layer.

Regarding to claim 44, Tanaka discloses in Figures 1-4 and 13, the nano-structures have ends that are slightly recessed from the surface of the emitter layer.

Regarding to claim 55, Tanaka discloses in Figures 1-4 and 13, an electron source comprising: a substrate (42); electrode means (52), disposed over the substrate, for providing a source of electrons; means (54 and 56), disposed over the source means, for emitting electrons provided by the source means into a vacuum, the emitting means including nano-structure emitting means (56) for providing a flow of electrons and field-

enhancement means for lowering a threshold field at which the emitting means emits electrons; an insulator (46) disposed over the emitting means (54 and 56); and gating means (48), disposed over the insulator (46), for controlling the flow electrons emitted by the emitting means.

Regarding to claim 56, Tanaka discloses in Figures 1-4 and 13, the gating means (48) and the insulator (46) each include one or more apertures (50) that expose the nano-structure emitting means to the vacuum.

Regarding to claim 57, Tanaka discloses in Figures 1-4 and 13, the nano-structure emitting means (54 and 56) is a conductive material and the field-enhancement means is an insulating material.

Regarding to claim 58, Tanaka discloses in Figures 1-4 and 13, the nano-structure emitting means (54 and 56) is an insulating material and the field-enhancement means is a conductive material.

Regarding to claim 59, Tanaka discloses in Figures 1-4 and 13, an electron field emission composite comprising: one or more nano-structures (56); an embedding material (54) in which the nano-structures are embedded, the embedding material (56) having a surface at which ends of the embedded nano-structures (54) are truncated and exposed, the exposed ends of the nano-structures configured to emit electrons when

under the influence of an electric field applied in a vacuum proximate to the exposed ends.

Regarding to claim 60, Tanaka discloses in Figures 1-4 and 13, the intensity of the applied electric field in vacuum is increased at the exposed tip of nano-structures by the presence of the embedding material.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 5, 8, 10, 22, 24, 27, 37, 38 and 61-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,777,427 to Tanaka in view of U.S. Patent No. 6,283,812 to Jin.

Regarding to claim 5, Tanaka discloses in Figures 1-4 and 13, an electron source comprising: a substrate (42); a cathode (52) disposed over the substrate (42), the cathode (52) for providing a source of electrons; an emitter layer (54 and 56) disposed over the cathode (52) and formed from a composition of an embedding material (54) and a plurality of nano-structures (56) embedded therein, the emitter layer (54 and 56) having a

surface at which ends of the nano-structures are truncated and exposed for emitting electrons; an insulator (46) disposed over the emitter layer, the insulator having one or a plurality of apertures (50) for exposing the ends of the nano-structures; and a gate electrode (48) disposed over the insulator (46) and having one or a plurality of apertures that are aligned with the apertures in the insulator (46), the gate electrode (48) for controlling the emission of electrons through the apertures from the exposed nano-structures.

However, Tanaka does not specifically disclose the embedding material is composed of multiple different materials.

Jin teaches in Figures 4 and 5, an electron source comprising a embedding material (52) composed of multiple different materials (see column 7, lines 15-35) for the purpose of improving emission properties in aligned nanotube ensembles.

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilize the embedding material of Jin for the electron source of Tanaka for the purpose of improve emission property in aligned nanotube ensembles.

Regarding to claim 8, Jin teaches in Figures 4 and 5, the nano-structure is grown in alignment and with controlled spacing between nano-structures and the motivation to combine is the same as in claim 5.

Regarding to claim 10, Jin teaches in Figures 4 and 5, the nano-structures are prefabricated and the motivation to combine is the same as in claim 5.

Regarding to claim 22, Jin teaches in Figures 4 and 5, the conductive nano-structures are grown directly on the substrate and the motivation to combine is the same as in claim 5.

Regarding to claim 24, Jin teaches in Figures 4 and 5, the conductive nano-structures are grown with alignment and controlled spacing.

Regarding to claim 27, Tanaka discloses in Figures 1-4 and 13, the insulator nano-structures are grown on the substrate with alignment and controlled spacing between nano-structures.

Regarding to claim 37, Jin teaches in Figures 4 and 5, the conductive nano-structures are grown directly on the substrate and the motivation to combine is the same as in claim 5.

Regarding to claim 38, Jin teaches in Figures 4 and 5, the conductive nano-structures are pre-fabricated and the motivation to combine is the same as in claim 5.

Regarding to claim 61, Tanaka discloses in Figures 1-4 and 13, nano-structures are grown on a substrate and the motivation to combine is the same as in claim 5.

Regarding to claim 62, Tanaka discloses in Figures 1-4 and 13, the nano-structures are pre-fabricated; and wherein the embedding material is formed from slurry and the motivation to combine is the same as in claim 5.

Regarding to claim 63, Tanaka discloses in Figures 1-4 and 13, the nano-structures are insulators; and wherein the embedding material is a conducting material.

Regarding to claim 64, Tanaka discloses in Figures 1-4 and 13, the insulators are wide band gap semiconductors.

Regarding to claim 65, Tanaka discloses in Figures 1-4 and 13, the wide band gap semiconductors include diamond, AlN, AlGaN, BN, SiC, GaN.

Regarding to claim 66, Tanaka discloses in Figures 1-4 and 13, the slurry forms a conducting composite with carbon dispersed in glasses.

Regarding to claim 67, Jin teaches in Figures 4 and 5, the pre-fabricated nano-structure is formed from carbon and the motivation to combine is the same as in claim 5.

Regarding to claim 68, Tanaka discloses in Figures 1-4 and 13, the carbon includes carbon nanotube, carbon nanofiber, carbon nanocone, carbon nanoplane and carbon nanoparticle.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following prior art are cited to further show the state of the art of composition of an electron source.

U.S. Patent No. 6,545,396 to Ohki.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dalei Dong whose telephone number is (571)272-2370. The examiner can normally be reached on 8 A.M. to 5 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar Patel can be reached on (571)272-2457. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

D.D.
February 15, 2006

Karabi Guharay
Primary Examiner
Art Unit 2879